U. S. FOREST SERVICE

RESEARCH NOTE LS-13

LAKE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

Dieback of Sugar Maple, Upper Michigan — 1962

Beginning in 1958, observations on dieback of sugar maple (*Acer saccharum* Marsh.) and other northern hardwoods have been recorded on sample plots at the Upper Peninsula Experimental Forest at Dukes, Mich. Annually more than 2,000 trees are evaluated according to the birch dieback rating system of Hawboldt and Skolko.[1] Maple dieback is somewhat similar to the maple blight found a few years ago in northern Wisconsin except that dieback is most severe on large trees while maple blight causes severe injury to all size classes. Maple blight was caused by a complex of insect defoliation and frost damage. The cause of dieback is not known.

By the usual pattern of dieback symptom development, the crowns of affected trees appear healthy one year and then show dead twigs or branches the next growing season, indicating that the crown injury may be occurring during the dormant season. A few of the affected trees examined, however, first showed dwarfed or chlorotic foliage, followed by twig or branch mortality the next year.

Since 1958, dieback has appeared on a larger percentage of trees each year, although most of the newly attacked trees have less than 10 percent of their crowns affected. Most of the increases have been in the larger size classes (table 1). In 1958, 10.0 percent of 2,461 sugar maples inspected were injured; in 1960, 20.5 percent of 2,134 were injured; and in 1962 the proportion of injured had risen to 27.9 percent of the 2,152 trees examined. In contrast, yellow birch in the same stand in 1958 showed 47 percent of the trees injured, indicating that yellow birch was more severely affected.[2]

[1] *Hawboldt, L. S., and Skolko, A. J. Investigation of yellow birch dieback in Nova Scotia in 1947. Jour. Forestry 46: 659-671. 1948.*

[2] *For further information on yellow birch top-dying see:*

Godman, R. M. Progress of top-dying in yellow birch — Upper Michigan, 1954-1955. U. S. Forest Serv., Lake States Forest Expt. Sta. Tech. Note 444. 2 pp. 1956.

Godman, R. M. Changes in yellow birch top-dying, Upper Michigan, 1954-1957. U.S. Forest Serv., Lake States Forest Expt. Sta. Tech. Note 527. 2 pp. 1958.

Jacobs, R. D. Top-dying of yellow birch, Upper Michigan, 1955-1959. U.S. Forest Serv., Lake States Forest Expt. Sta. Tech. Note 585. 2 pp. 1960.

TABLE 1. — *Changes in dieback from 1959 to 1962*[1]
(In percent)

Crown condition	Tree diameter at breast height (inches)			
	5-9 (882 trees)	10-14 (479 trees)	15-19 (441 trees)	20 or more (214 trees)
Had dieback in 1959 and either improved or did not change	3.5	10.6	10.9	10.7
Continued deteriorating or began to deteriorate after 1959	4.3	25.7	35.6	44.9
Remained healthy	92.2	63.7	53.5	44.4

[1] *Includes only trees 5 inches or larger in 1959*

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As expected, injury was most severe in the larger size classes (table 2). Symptom progression in individual trees usually proceeds to a point where one-fourth to one-half of the crown is destroyed and then becomes stabilized. The dead branches are slow to rot and break out of the tops, so that recovery may not be apparent until several years after the dieback has stabilized. Also, in the taller trees annual terminal growth is often very small, and a considerable number of years may be required for the live terminals to grow back into the area occupied by the dead branches.

Dieback is also related to stand density (table 3). The percentage of injured trees is greatest in the heavily cut areas (30 square feet of basal area per acre in the residual stand) and considerably less in the moderately cut stands (50, 70, and 90 square feet of basal area). These differences occur primarily in the smaller size classes since the larger trees tend to have a large proportion of their numbers affected regardless of stocking level.

The cause of dieback remains unknown. No pathogenic organism has been found. Godman has speculated that top-dying in yellow birch in the Lake States may be the result of rootlet mortality caused by prolonged high water tables in the spring.[3] Drought conditions in the following years could result in extensive moisture deficiencies to the crowns because of lack of absorbing rootlets. High water tables are found in some sugar maple stands in the spring, particularly in heavily podzolized soils with hardpan layers close to the surface. The study of water table levels in relation to maple and birch dieback is being continued. Other possible causes are also being investigated.

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[3] *Godman, R. M. Are water table levels an important factor in the establishment and growth of yellow birch? Mich. Acad. Sci., Arts, & Letters Papers 44: 183-190. 1959.*

TABLE 2. — *Percent of trees by injury class within four diameter classes, 1962*[1]

Dieback class	Tree diameter at breast height (inches)			
	5-9 (940 trees)	10-14 (523 trees)	15-19 (470 trees)	20 or more (219 trees)
None	91.8	65.7	51.3	45.7
Abnormal foliage[2]	.1	.8	.2	.0
Moderate[3]	7.2	31.9	47.2	53.4
Severe[4]	.7	.8	1.3	.9
Dead[5]	.2	.8	.0	.0

[1] *Numbers of trees differ from those in table 1 because of additional trees reaching 5 inches d.b.h. and changes among diameter classes in the larger trees.*
[2] *Dwarfed or chlorotic.*
[3] *Less than one-half the crown affected.*
[4] *More than one-half the crown affected.*
[5] *Died in 1962.*

TABLE 3. — *Relationship of dieback to stand density*

Basal area (sq. ft. per acre)	D.b.h. (inches)	Percent of trees		Basis: no. of trees
		Healthy	Injured	
30	5-9	84	16	176
	10-14	47	53	107
	15-19	36	64	63
	20+	40	60	5
50	5-9	93	7	315
	10-14	67	33	144
	15-19	43	57	118
	20+	51	49	39
70	5-9	93	7	259
	10-14	70	30	137
	15-19	55	45	142
	20+	41	59	81
90	5-9	95	5	190
	10-14	76	24	135
	15-19	60	40	147
	20+	48	52	94

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K. J. KESSLER, JR.
Plant Pathologist